TRANSPORT TECHNOLOGY AND THE "REAL WORLD"

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> "The most dangerous notion an age of automation can entertain is the belief that machines have goals of their own, to which man must submit if he knows what's best for him" -- Lewis Mumford.

In looking at the development of transport technology over the last 5,000 years, and especially over the last fifty years, one cannot help but be struck by the absolutely fundamental impact this development has had upon the character of our society and upon our very mode of life. Above all one is impressed, in reading Professor Kranzberg's eloquent "Lessons of History,"** by the extent to which transport technology in the past has responded to the demands of society, to human needs and to social purposes.

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**Melvin Kranzberg, "The Social Impact of Transport Technology: Some Lessons of History," background paper for Panel 2 at the Hartford Symposium.

The interaction between transport technology and the needs of society has been close. The rail and locomotive revolution of the 19th century was a response to the heavy overland transport demands of an industrializing society; the highway and automotive revolution, of the early 20th, was a reaction to the desire for vastly greater individual flexibility and mobility and to the increasingly dispersed locational patterns of an urbanized world; and, most dramatically of all, the aeronautical revolution of our own era sought to fulfill man's desire to overcome the obstacles of time and space, to span his continents and to shrink his planet. In taking the retrospective view, even the most romantic and conservative exponent of the "good old days" and of the preindustrial bucolic life, will have to admit that transport technology has transformed modern society, has increased the productivity and efficiency of man and has enhanced his possibilities for enjoyment of life.

But somehow, in recent years, transport technology appears to be suffering from a progressive disorientation, a loosening of the close link to its environment that has characterized its past development. Increasingly transport technology gives the impression of developing in a vacuum, of pursuing visionary dreams, of engaging in gadget worship as an end in itself. Of the many brave new technological promises that are being held out, few show signs of being aimed at meaningful purposes -- least of all at the fundamental purpose of transportation: <u>to reduce the cost and to enhance the facility with which we can move our goods and people about</u>.

There is a malaise -- but it is far easier to describe some of its symptoms than to diagnose it:

(i) There is a heavy concentration upon the vehicle rather than upon the organic functions of the system. Thus such a meaningless concept as "the DC-3 replacement" continues to be discussed sagely and sometimes heatedly, as if the DC-3 today still played an identifiable single functional role, instead of being an almost thirty-year old design concept which has been replaced many times over. Surely it should be clear by now that, thanks to its unprecedented reliability and virtual depreciationless status, the DC-3 fell heir to numerous roles for which it was never intended. Technology can easily improve upon it, but only by focussing upon these roles, not upon the hopelessly obsolescent vehicle. And yet this simple point is still so widely misunderstood. All too often in our thinking it is the gadget that stands at the center of our development effort. Only after it has been created do we ask what kind of functional role it can perform and we then try to fit people to it.

(ii) There is much neglect, and sometimes reckless disregard, of the social and human consequences of our new creations. Few will doubt the virtues of the Vertical-Rising Air Bus of Tomorrow* for the very short haul downtown-to-downtown transportation task, but some may wonder whether the city dweller will welcome with unmitigated delight the deafening roar that will emanate from the vertical lift engines with each landing and departure. Similarly, for the supersonic transport, FAA's judgment may well be right that an eardrum tolerance factor

*See Hall L. Hibbard, "The LiftLiner: Vertical-Rising Air Bus of Tomorrow," background paper for Panel 1 at the Hartford Symposium.

of 1.5 pounds per square foot for sonic boom overpressures will be medically acceptable; but the socio-political tolerance factor for such artificially-induced thunderclaps may be a lot less.

(iii) There is a tendency to favor transport technologies whose social significance is inversely proportional to their cost. The SST, while holding out the dramatic prospect of commercial passenger flight at supersonic speeds, is hardly likely to revolutionize mass travel habits, locational preferences, or the distribution of economic activity. Is this a socially worthwhile investment choice? Cutting a few hours off the pleasantest and most relaxing part of travel time, namely airborne time, while allowing ground times to pile up and air travel costs to rise, may not be the best way to squeeze out the great social benefits that technology might have to offer. If our concern really is to increase the productivity of the busy executive during his time-away-from-office, there are ways of doing this at a fraction of the cost of an SST development, such as by providing him with efficient air-ground communication in the present subsonic jets.

(iv) There appears to be an almost calculated disregard of the cost implications of a new innovation and of the economic environment in which it will have to operate. What will be the development cost of the vehicle and, more important, of the system that must be built around it? What price will people be willing to pay for the improved service it provides? With what improved present forms of transport will the new system have to compete by the time it goes into operation? This latter question is most notoriously neglected. For example, if we do develop a VTOL downtown-to-downtown passenger system

it may have to compete not with present speeds and costs of surface transport, but, say, with a vastly improved high-speed rail system between city centers that might be developed at substantially lower cost. Similarly, the supersonic transport of the early seventies will be competing with costs of subsonic jet travel that may be some 30 per cent below present seat-mile costs, given the possibilities for vehicle enlargement and modest improvements in power plant that are already at hand.

How do we explain these symptoms of a progressive disorientation, of a growing separation of technology from the larger, social and economic context within which the basic transportation task is posed? The answer is not obvious, but several points might be made.

First, the task for technology has become a lot harder. We may be at a stage in the evolution of transport technology where further innovations tend to yield decreasing returns to increasing performance. That is to say, transport technology today can no longer look forward to the kinds of dramatic gains in mobility and efficiency that were brought about by the remarkable developments of the last fifty years. Even very appreciable future reductions in engine sfc's, order-of-magnitude increases in speed, and lavish introduction of automated control devices, are not likely to lead to the revolutionary gains in transport productivity, capacity and efficiency that we have experienced in the past.

Second, the cost of developing entire new transport systems has risen astronomically, and the gestation period for carrying such development programs to completion has become extraordinarily long. The start-up cost of a modern aircraft development program is measured in the

tens and sometimes in the hundreds of millions of dollars.

Third, the decision-making unit in R&D has become inordinately large and cumbersome. The modern engineering enterprise, with its complex corporate structure, cannot make a costly development decision with the risk-taking abandon that was typical of the individual inventor or innovator of the past.

Finally, and perhaps most important, the traditional market mechanism of supply and demand, on which we have long depended for guiding our technological development decisions, does not provide us with unambiguous signals as to what may be an efficient development choice. It is simply not adequate in reflecting the long-range values that have to be weighed if rational technological decisions are to be made.

This last point seems to me particularly relevant in facing up to the task of "applying the new transport technology to social and economic problems." For the central deficiency of the market system is being increasingly recognized: its inability to express long-term public needs alongside of short-term private demands and its inherent long-range goal setting weakness. There is a growing clamor that technological research and development no longer be left purely to the mercy of a near-blind market, and be directly organized by the government so as to achieve planned socio-economic goals. I do not wish to argue the question of whether it is an appropriate role for government to finance or assist research and development. Clearly, there are solid arguments both pro and con. But if the purpose of the government intervention is to correct the goal setting deficiency of the market mechanism, it does seem to me appropriate to discuss at least one of

the problems central planners may face in attempting to take over the market function of setting goals and objectives -- and that is the problem arising from the existence of multiple objectives.

The fact is that transportation is hardly ever desired for its own sake: it is merely a means to serve other objectives. Some of these are economic efficiency objectives, others are just as broad and diverse as the objectives of community development itself (political, social, military, etc.). The point is that these objectives are invariably competing, often incommensurate and sometimes incompatible with one another, and the mere enumeration of these objectives in no sense solves the problem of choosing among them. The existence of conflicting objectives presents us with a real-world dilemma to which there is no impersonal scientific solution. I think it is important that we not deceive ourselves into thinking that the central planner has some magic that enables him to resolve this dilemma and to make clear-cut objectives choices.

The fact is that there is no single optimum transportation system that would satisfy all of the diverse purposes that a nation or a community seeks to pursue simultaneously. Even the economist, who is supposed to deal in the science of rational choice, has little to offer in this matter. Economics after all deals with the logic of the allocative process -- it tells us <u>how</u> to choose but not <u>what</u> to choose. The economist is at his best in finding the most efficient or the least-cost method of achieving a precisely expressed objective. But economists are quite frustrated when confronted with a list of independent competing goals and are asked to select the appropriate mix of such goals. Such a selection must inevitably be a subjective judgment. The choice

of a transportation system for a community or a transportation technology for a nation, is, in a sense, a choice of a strategy for growth, a choice of a path and quality of community development. This is not an efficiency problem amenable to a least-cost calculus, but it is a kind of high-level policy decision to which no single criterion is appropriate. To a large extent it is an intuitive and subjective decision, often based on a faith that certain objectives are more important than others.

I am not asserting that economists and planners have no important contribution to make to this problem of objectives choice. On the contrary, they have a very special and useful role to play, namely that of providing the decision-makers (the voter, the tax payer, the community) with the terms of exchange or trade-offs among different objectives, so that they can better choose among the possibilities open to them on the basis of their own utility pattern or the community's system of preferences. Such terms of exchange can clarify the question of "how much of one goal might we be willing to trade to obtain more of another?" And this will enable the community to choose more wisely among the alternatives open to it. What the planner can do here is not to select a single best transport system, but to marshall the data on the costs of alternative transport systems that will achieve different combinations of objectives. In short, economic analysis and "planning" can be very important, but it must take the form of a logical ordering of a problem, of providing relevant information on performance and costs that may help in making subjective decisions.

What I am suggesting is a role for the central planner that he can legitimately perform without usurping the community's prerogatives of

making their own value choices. His role should be that of illuminating possibilities open to the community; that of formulating and portraying alternative future paths that could be followed and clarifying both the cost and the value implications of choosing one or another of these paths. The planner's performance in illuminating choices can be a powerful factor in shaping the evolution of these values -- not by substituting or imposing his own values and preferences upon our society, but by broadening the scope and sophistication of our understanding of our goals. Broadening our perception of alternatives is one of the valuable contributions the planner can make to his community.

And this point is of particular importance to the transportation planner, since clearly transportation decisions have an enormous potential impact on the quality and character of community life and on the locational pattern of economic activity. Moreover, I believe it would be an error for the planner to accept the community's current objectives and values as given and to try to build a transportation system to match them. Almost certainly the goals will be changed by the process of growth and by the very transportation path that will be followed. Instead, the transportation planner should attempt to present to the community a series of feasible, efficient alternatives, showing for each alternative the consequences for their future welfare and their way of life of pursuing that alternative consistently. It is only in this way that the community can clarify its goals and can be encouraged to make an intelligent selection among the alternatives open to it.

My impression is that, at least in the field of urban transportation planning, this concept of the planner's role is virtually

unheard of.* In the Greater Washington Metropolitan area, for example, there is today no lack of a government role. To my knowledge, we now have no less than seventeen agencies concerned with urban transportation. But this gargantuan effort has not to date yielded a plan that presents, in any sense, a range of alternatives for public discussion. I have never yet seen a plan that recognizes explicitly the enormous uncertainty about our future path of development, our abysmal ignorance of changing community values, and our lack of awareness, even, of present consumer preferences. What is typically served up to us on a take-it-or-leave-it basis, is a single ingenious and elaborate scheme of transportation development that ignores the intangibles and complexities of the real world, conceals the immense weight of uncertainty about the future and often cloaks itself in a pseudo-scientific mantle of exotic mathematical symbology that oversimplifies complicated reality, excludes important insights and denies the fact that lack of quantitative guidance is a permanent and unavoidable condition.

If we are serious in our concern about the deficiencies of the market in guiding technological choices and if we feel that we must correct these deficiencies by supplanting or, at least, supplementing the market with conscious guidance from the center, we shall have to be on guard against actually believing in the "scientific" nature of the planning process; against surrendering to the pressure to quantify the unknowable; against engaging in mechanical projections of past indices; and against ignoring the distinction between obtaining efficiency and imposing a value choice. In planning for transportation

*The Penn-Jersey Transportation Study may be a notable exception.

technology, above all, we will do well to study more carefully the changing needs and wants of people and their production units -- the increasingly dispersed locational patterns of our industries and the rising preferences for privacy, flexibility and accessibility of our consumers. We will never be able to discern with confidence the precise path of development that our future society will take. But the least we can do is to offer up a range of meaningful alternatives and thus to preserve the possibility for choice.

What I have argued so far suggests that I have less than perfect faith in the inevitable beneficence of transport technology, as such, for social and economic problems. The impact of transport technology may be malignant or it may be benign. It may help create an intolerable urban monster or it may add immensely to urban productivity and welfare. It is an instrument at the disposal of man and it may be used well or badly. But even at its best, it is only a limited instrument which cannot, of itself, "solve" social or economic problems. This leads me to my last observation, namely that transport technology should not be embraced too enthusiastically as the magic wand that will overcome poverty and economic backwardness.

There can be little doubt that, in most underdeveloped countries, immobility and isolation constitute important impediments to economic growth and social interaction. It is also quite evident that more extensive and more efficient transportation systems are one of the many ingredients that transitional societies need in order to accomplish their social transformation. But what I question is that this should be viewed as a problem for technology. Western technology is of course desperately desired in most underdeveloped countries, since it is to

them the most easily visible distinction, the most apparent deficiency, that separates their societies from ours. But in fact it is not technology, but the fruits of technology, that are most of all wanted -- industry to enhance their productivity, modern weapons to ensure national independence, and education to help transform life. These fruits of technology, however, imply so much more than merely the machine, the mechanism, the device; they imply an entire cultural foundation.

What is perhaps not sufficiently appreciated, both in the industrial and in the preindustrial world, is the enormous gulf that separates these two kinds of cultures. We take science and technology for granted, we grow up with it. In the less-developed countries children grow up in a world saturated with nonscience, with a view of nature that is nonrational and nonobjective, often suffused in a religion that is a vital and necessary part of living and offers no strong motivation for social change. In such countries, more often than not, science is regarded as a charm to ward off evil spirits or to ensure good. Before technology can in fact be effectively absorbed in most of the developing countries, they will need to have their own scientific revolutions -- the kind of profound cultural change that, in the West, was spread over generations. Such a technological revolution will affect these countries in their deepest traditions, not merely on the surface of work habits, hours, dexterity and techniques, but it will profoundly alter their status within the community, their religious philosophy, their ethics and their social structure. If technology is seriously to be introduced and effectively to be absorbed, such revolutions must be inevitable. We must be aware of how painful

and costly such changes must be, threatening as they do the very cultural foundations of the community. And we must be aware of the many-faceted nature of the changes that are involved. In this context it hardly makes sense to speak of technology as if it stood at the center of the stage in the vast accelerating drama of social transformation that we are trying to assist.

No doubt, technology can play a part, and transport technology may have a valid claim for special relevance. But its role can be meaningful only in a much larger context of interaction, in which we understand ourselves as the technologically oriented culture that we are, understand the nontechnologically oriented culture of our neighbors and, above all, seek to develop effective communication between the two that will overcome the barriers of language and culture as well as those of technology.